Amended Claim 4 to Obtain Allowance of Case

4. (Currently Amended) A method for the generation of a three dimensional fractal subsurface structure by Voronoi tessellation and computation of gravity response of such fractal structure, by generation of fractal subsurface structures and computation of a forward gravity response of such structure for delineation and modeling of an underlying anomalous object, said method comprising:

(a) selecting Voronoi centers at a plurality of locations over a region of interest, the Voronoi centers being represented by x, y, z co-ordinates;

(b) generating an initial model of a subsurface fractal geological object, having variation in a physical property in lateral and vertical directions; the initial model being generated by tessellating the Voronoi centers, and assigning values of physical property variations during generation of the model on the basis of pre-determined assumptions in the model;

(c) assigning different discernable representations to regions in the model which have different physical properties to enable demarcation;

wherein the fractal subsurface model is generated by a modified Voronoi tessellation technique which comprises modifying the Voronoi tessellation by using L^p norm, where $L^p = (x-q_i)^{1/p}$, where x is an arbitrary point, q_i is point whose distance has to be calculated, and p is an exponent which can assume fractional real numbers and negative real numbers thereby enabling greater range for generation of different fractal sub-surfaces, which are closer to a real geological situation,

wherein the computation of a gravity response due to a fractal subsurface generated by modified Voronoi tesselation is carried out by an analytical expression which comprises:

(a) demarcating boundaries of regions having a different physical property in the

tessellated region, the boundaries forming a polygonal shape in 2-dimensional space;

$$V = G\rho \sum_{i=1}^{n} [W \, arc\cos\{(x_i / r_i)(x_{i+1} / r_{i+1}) + (y_i / r_i)(y_{i+1} / r_{i+1})\}$$

$$- arc\sin \frac{zq_i S}{(p_i^{\,2} + z_i^{\,2})^{1/2}} + arc\sin \frac{zf_i S}{(p_i^{\,2} + z_i^{\,2})^{1/2}}]$$

Where S= +1 if p_i is positive, S= -1 if p_i is negative,

W= +1 if m_i is positive, W= -1 if m_i is negative,

'Z' is depth and 'n' is number of sides in the polygon.

G is universal gravitational constant, ρ is the density of the tessellated regions;

$$p_i = \frac{y_i - y_{i+1}}{r_{i,i+1}} x_i - \frac{x_i - x_{i+1}}{r_{i,i+1}} y_i,$$

$$q_i = \frac{x_i - x_{i+1}}{r_{i,i+1}} \frac{x_i}{r_i} + \frac{y_i - y_{i+1}}{r_{i,i+1}} \frac{y_i}{r_i},$$

$$f_i = \frac{x_i - x_{i+1}}{r_{i,i+1}} \frac{x_{i+1}}{r_{i+1}} + \frac{y_i - y_{i+1}}{r_{i,i+1}} \frac{y_{i+1}}{r_{i+1}},$$

$$m_i = \frac{x_{i+1}}{r_{i+1}} \frac{y_i}{r_i} - \frac{y_{i+1}}{r_{i+1}} \frac{x_i}{r_i},$$

$$r_i = +(x_i^{\,2} + y_i^{\,2})^{1/2},$$

$$r_{i+1} = +(x_{i+1}^{\,2} + y_{i+1}^{\,2})^{1/2},$$

$$r_{i,i+1} = +[(x_i - x_{i+1})^2 + (y_i - y_{i+1})^2]^{1/2}$$

p_i = perpendicular to a side of an irregular geometrical body from a point at which anomaly is being calculated;

$q_i = \cos(\theta_i)$, where θ_i is an angle between a side of the irregular body and line joining the first point (A) of the arm from the point at which anomaly is being computed;

$f_i = \cos(\varphi_i)$, where φ_i is an angle between a side of the irregular body and line joining the end point (B) of the arm from the point at which anomaly is being computed,

m_i = angle subtended by an arm of the irregular body at the point where anomaly is being computed;

r_i = distance of a point at the boundary of irregular body from the point at which anomaly is being computed;

r_{i+1} = distance of next consecutive point at the boundary of the irregular body from the point at which anomaly is being calculated;

$r_{i,i+1}$ = length of the side of the irregular body;

i = is a subscript, which is used to select the next consecutive point on the surface of the body;

where the effect of a common arm of the adjacent polygon is removed;

(b) repeating the gravity response computation due to the polygon for all adjacent polygons of different physical properties using the demarcated polygon boundary;

(c) adopting the process of gravity response computation for tessellated regions lying at different depths to obtain a response;

(d) integrating the response using Simpson/Gauss quadrature formula at plurality of grid nodes overlain on the region of interest; and

(e) creating a model of the underlying anomalous object.